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TITLE

AN INSTANCE OF
WINTER MORTALITY OF BROODS OF THE
MOUNTAIN PINE BEETLE
1949-50

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The winter of 1949-50 was unusually severe in western Montana and northern Idaho. Within that region were areas on which control projects against the mountain pine beetle in lodgepole and western white pine were planned. Each winter there is a possibility of local temperatures lethal to bark beetles having occurred. Therefore, it is customary to check for possible abnormal winter mortality of broods of the mountain pine beetle on areas where control is contemplated. This routine check assumed added importance when it was learned that not only had there been unusually low temperatures during the winter but a spell of mild weather had occurred in February and early March. This was followed by a cold wave bringing below-zero temperatures in many areas. Such unseasonable weather is known to cause heavy mortality of bark beetle broods under certain conditions.

Experiments by Evenden and Terrell⁽¹⁾, and Bedard⁽²⁾ show that bark beetle broods gradually develop cold-hardiness when normal pre-winter weather occurs in the fall. At the end of this cold-hardening period, bark beetle broods can survive the lowest winter temperatures encountered in their environment. However, if mild weather persists in the fall until there is a sudden onset of low temperatures, bark beetle broods do not develop this protective condition and are readily killed. Also the breaking of this cold-hardiness by a period of mild weather, followed by a cold wave, is destructive to overwintering bark beetle broods. That such a condition may have developed in early March seemed quite possible.

It was important that information on bark beetle survival be obtained as soon as possible because of its bearing on prospective control projects. Examinations were begun in late March. They revealed high mortality in some areas and variable amounts in others, with an overall obvious need for further work to reveal the true picture of the situation. Winter conditions made it advisable to defer examinations on some areas until travel was easier.

(1) Low Temperatures Critical to Bark-beetle Larvae, by Evenden and Terrell 1937, C'dA Forest Insect Laboratory Report.

(2) The Effect of Tempering as a Means of Increasing Cold-Hardiness Upon the Lipid and Moisture Content of Mountain Pine Beetle Larvae by W. D. Bedard 1937 C'dA Forest Insect Laboratory Report.

These additional examinations were completed by May 5. During the period between March 21 and May 5 all units on which control had been planned in 1950 were examined. They included the Thompson River project, the Boulder Creek area on the Kootenai, and the Yellow Dog-Downey-Sissons area on the Coeur d'Alene Forest. Personnel from the Forest Insect Laboratory, the regional forest office and local forest offices, cooperated in obtaining the necessary data. To obtain the data, a few long trips were made on snowshoes, others on skis.

For use of the Coeur d'Alene Laboratory in determining the areas where winter kill might have occurred, the Forest Service obtained recent reports of weather stations in the vicinity of bark beetle infestations.

On the Thompson River drainage, mortality was found to have been complete on some areas and varied from heavy to practically none on others. At the Upper Ford Ranger Station on the Kootenai Forest, complete mortality was also reported above the snow line but the not-far-distant Boulder Creek area, and the Yellow-Dog-Downey-Sissons area of the Coeur d'Alene Forest showed no significant mortality. In the following tabulation the results of the examinations are recorded for the various areas. Mortality figures given are only for insects above the snow line. Insects below that were unaffected. As the number of surviving insects per square foot had an important value from a control standpoint, it is given wherever available.

MOUNTAIN PINE BEETLE MORTALITY IN LODGEPOLE PINE

Lynch Lake 3-28-50

<u>Number of Trees Examined</u>	<u>Sq. Ft. Bark Examined</u>	<u>Percent Mortality</u>	<u>Survivors per Sq. Foot</u>
17	50	100	.68

Pleasant Valley River

2	2	100	None
6	6	99.2	.67
1	6	100	None
4	7.2	100	None

Middle Thompson Lake

7	7	90+	2.14
The preceding 7 trees were on slopes.			
38	56	96.0	.98
The preceding 38 trees were on a flat bordering the lake.			

Yak Vicinity

2	2	90+	5.00
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Boiling Springs Creek

3	3	98.9	1.0
The preceding 3 trees were on the bank of the creek.			
4	4	92.5	5.25
These trees were on the hillside 50 ft. above the preceding 3 trees.			
3	3	83.2	8.33
These 3 trees on slope 25 to 50 feet above preceding 4 trees.			
8	8	37.5	38.12
These trees were about 300 feet above the creek bottom.			

Examinations made on Boiling Springs Creek showed an increase in number of surviving insects with increase in altitude above the basin through which the creek flows. This trend may be considered as evidence of settling of lethal cold air into the basin with progressively warmer temperatures prevailing at increasing height on the hillside.

<u>Number of Trees Examined</u>	<u>Sq. Ft. Bark Examined</u>	<u>Percent Mortality</u>	<u>Survivors per Sq. Foot</u>
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Lost Prairie

11	18.8	100-	.37
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Yask - Bend

9	9.0	95.5	1.56
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These trees were on the flat and low slopes close to the river.

10	9.25	50-60	16.11
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These trees were on the bench 75-100 feet above river.

Similar to conditions on Boiling Springs Creek, we found high mortality in the lowest parts of the Yask-Bend area, by the river, and increasing survival with increase in altitude above the bottom of the drainage.

Lazier Creek

6	6.0	91.8	6.0
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The preceding trees were on a high slope.

6	6.0	98.6	1.0
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The preceding trees were in the creek bottom.

Meadow Creek

8	8	7.1	55.5
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The preceding 8 trees were at least 500 feet above the creek bottom on a north-facing slope.

7	11.0	48.2	12.8
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The preceding 7 trees were on a gentle south-facing slope on a bench above and about 1 mile west of the river.

<u>Number of Trees Examined</u>	<u>Sq. Ft. Bark Examined</u>	<u>Percent Mortality</u>	<u>Survivors per Sq. Foot</u>
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Meadow Creek cont.

4	13	75-85	3.3
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These trees were in the bottom land of Meadow Creek.

1	1	61.1	7.0
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The preceding trees were on a south-facing slope about 200 feet above the creek.

4	4	27.9	37.5
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The preceding 4 trees were on a ridge about 1 mile north of Meadow Creek and 400-500 feet above it. Surviving insects were chiefly large larvae and a few callow adults. On other areas survivors were chiefly small larvae. The site was a warm one.

Back Creek

6	30.0	93.6	.37
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Thompson River

9	11.0	100	None
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2	1.0	80-90	3.00
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5	5.0	100	None
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Little Thompson River

15	26.5	95+	2.15
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Parktable - Deerhorn Creek Vicinity

8		50-75	not recorded
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The survival indicated that this locality was near the southern limits of the region affected by the lethal temperatures.

The highest survival was on benches above the river, the least was close to the river.

Most of the surviving insects were in the early larval stages of development. Even under normal conditions mortality is high in these stages and few small larvae develop to new adults and emerge. Survival to new adults thus may be expected to be quite light. It was observed that a higher percent of survival of predatory clerid larvae occurred than of these immature stages of the mountain pine beetle. If other predators and parasites show similar survival it is quite possible they will be more effective than normally as they will have been building up for a much more numerous host than will be available.

It should again be pointed out that insects below the snow level at the time of this unseasonable temperature were unaffected. Reinfestation could therefore have been expected, but in greatly reduced amount on most units. Exceptions to this generalization were indicated for the Boiling Springs and Meadow Creek areas. Especially was this true in Meadow Creek where surviving insects on the south-facing slopes were not only numerous but in advanced stages of development.

OTHER AREAS EXAMINED TO DETERMINE WINTER MORTALITY

An inspection of the Upper Ford area on the Kootenai National Forest revealed the same high mortality observed in the drainage bottoms of many areas on the Thompson River Control Unit. If anything, mortality may have been even higher on the valley floor there, than on the Thompson River Unit, as recorded survival averaged only .1 insect per square foot above the snow line. It is quite possible the reinfestation noted on the Upper Ford area was due partly to heavy emergence from the portion of the infested trees below the snow line. A further possible source of reinfestation could have been from trees on slopes above the zone of lethal temperatures. It is known that, in the absence of wind, cold settles into sheltered basins and the lower parts of drainages to produce temperatures well below those on adjacent slopes and higher land areas. Some of these temperature differences may well have been on the borderline of lethal effect on bark beetle stages of development.

A report of the Boulder Creek infestation on the Kootenai National Forest failed to show any mortality from unseasonable temperatures.

Inspection of mountain-pine-beetle-infested western white pine on the Coeur d'Alene National Forest also failed to reveal any substantial reduction of bark beetle stages due to the unseasonable weather.

CONCLUSIONS

From examinations made during March, April and May it was found that, in some localities, unusually high winter mortality occurred to immature stages of the mountain pine beetle during the winter of 1949-50. There is evidence that the unseasonably warm spell of February and March of 1950 broke cold-hardiness of overwintering stages of the mountain pine beetle in some areas and caused more or less mortality when subsequent sub-zero temperatures occurred. Abnormal but incomplete mortality of overwintering bark beetle stages is considered by the writer as evidence of borderline lethal temperatures having occurred in some areas at certain elevations above drainage bottoms. What this borderline temperature is, is not known, because of the many variable factors upon which the production of lethal temperatures are dependent. Further, there are indications of individual insect differences in resistance to cold temperatures. This is indicated by survival of some and death of other insects under apparently identical conditions.

As a result of these examinations, many areas were eliminated from planned control operations in 1950. This made possible the saving of large sums of money of private operators and public agencies.